UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-8064

November 8, 2001

MEMORANDUM FOR: Arthur T. Howell, III, Director
Division of Reactor Safety

FROM: Troy W. Pruett, Senior Reactor Analyst ***/RA/***
Division of Reactor Safety

SUBJECT: DIFFERING PROFESSIONAL VIEW REGARDING THE CONTINUED PERFORMANCE OF SIGNIFICANCE DETERMINATION PROCESS (SDP) PHASE 2 ANALYSES

The continued use of the Manual Chapter 0609 Phase 2 analysis process should be discontinued. The process is cumbersome, difficult to utilize, time consuming, inflexible, and frequently provides inaccurate results. The continued development and use of the Phase 2 process will not necessarily ensure safety is maintained, is inefficient and ineffective, and will place an unnecessary regulatory burden on licensees.

Perspective on the Staff's View of the Phase 2 Process

The following comments were made verbally or provided in written correspondence:

- I am seeing my fears about introducing risk analysts into the process being realized. Sometimes too much of a focus on obtaining a risk-based number vice a legitimate risk-informed outcome for the observed deficiency gets in the way. The ROP will be revised to appropriately mitigate this.

- I have been hearing some items from the staff regarding the continued uncomfortableness of SRAs in using Phase 2 workbooks, despite the successful benchmarking efforts over past several months. I sense that the SRAs want a gold-plated, sophisticated risk-model equivalent tool, as opposed to an effective, inspector friendly tool that is appropriately risk-informed. I am concerned that we are undermining all the good that the ROP can provide in terms of risk-informing the process by which we assess licensee performance by tying ourselves up in lengthy, resource consuming risk analyses.

From my perspective, NRC management in NRR believes that the SDP Phase 2 process provides an adequate assessment of inspection findings and effectively utilizes staff resources.

Differing View - The Phase 2 SDP Process Does Not Ensure Safety:

The Phase 2 notebooks are not an independent assessment tool. The Phase 2 notebooks are derived from the initial submittals of Individual Plant Examinations (IPE). The validity of the models used to develop the IPEs received minimal scrutiny by the Agency. Benchmarking to support the adequacy of the Phase 2 notebooks determined whether or not alignment existed

between the licensee's original IPE submittal and the current update of the licensee's PRA model. Again, the validity of the licensee's current PRA model has also received minimal scrutiny by the Agency. Consequently, the results of a Phase 2 analysis do not necessarily provide an accurate assessment of the significance of a particular issue. The Phase 2 analysis result provides an oversimplification of the licensee's PRA model and does not provide an independent assessment of the significance of a particular finding.

The quality of the Phase 2 notebooks, as evidenced by the two rounds of benchmark trips, is unsatisfactory. Specifically:

- The first round of benchmark trips conducted in 2000 concluded that the Phase 2 notebooks needed significant revision. Consequently, significant resources were expended to add additional elements to the existing Revision 0 notebooks.

- 3 of 7 Revision 0 notebooks underestimated the significance in more than 10 percent of the conditions reviewed. Consequently, if acted on, 10 percent of the conditions analyzed by a Phase 2 notebook could result in a regulatory conclusion which underestimates the safety significance of the issue.

- 6 of 7 Revision 0 notebooks over estimated the significance for between 11 and 41 percent of the conditions reviewed. This has actually been incorrectly reported to NRC management. The benchmark results are based on a comparison of the risk significance for conditions lasting one 1 year (See attached data sheets). Shorter intervals result in significantly more over conservative results. While this may provide a safety benefit, it places a regulatory burden on the licensee and results in inefficient use of staff resources.

- 1 of 7 Revision 0 notebooks necessitated removal from the public website due to gross inaccuracies.

Essentially, if executed perfectly, the post benchmarked Phase 2 notebooks should provide an over conservative estimate approximately 90 percent of the time. These results were obtained with the use of a panel of highly informed and trained risk analysts from BNL, INEEL, NRR, RES, and Regional offices. Even these individuals had difficulty completing condition assessments using the Phase 2 notebooks. Individuals with less training and information should not be expected to produce the same results. Consequently, what may produce an above average result with highly skilled personnel is likely to produce a below average or unsatisfactory result with the lesser skilled inspection staff. Additionally, the web based training being developed by the TTD does not enable the inspection staff to complete the more complex Phase 2 determinations.

If the licensee revises their PRA model, the Phase 2 notebooks will produce an even greater number of inaccurate results. Currently, there are no plans to provide periodic and long term maintenance of the Phase 2 notebooks. Without resource intensive updates, the Phase 2 notebooks have the potential to produce a higher percentage of results which do not reflect the actual safety significance.

A review of Revised Oversight Process data for the first 5 quarters of implementation was performed. Per SECY 00-0009, the staff was to complete a Phase 3 analysis for any Phase 2

analysis. This action was to ensure an appropriate assessment of risk was completed while the Phase 2 notebooks were in development. 706 green findings, 22 white findings, and 1 red finding were issued. During the same period, 97 Phase 3 evaluations were performed. No data was collected to ensure that all Phase 2 evaluations received a Phase 3 evaluation. In addition, recently completed assessments of inspection reports by NRR suggest that several issues were evaluated as green without the benefit of a Phase 3 analysis. Using the suspect Phase 2 notebooks to determine an issue is green has the potential to impact both safety and the regulatory process.

Based on discussions with the inspection staff, there is confusion regarding what constitutes a completed Phase 2 notebook. Does a Revision 0 Phase 2 notebook function as a stand alone risk tool or does a Revision 1 Phase 2 notebook need to be issued?

Differing View - The Phase 2 Process is Inefficient and Ineffective

The new assessment process began in April 2000. Well over a million dollars has been spent and additional large sums of money are being allocated to continue the development of the at-power Phase 2 notebooks. After a year and a half, the NRC still does not have a single approved notebook. A Revision 0 of the plant specific notebooks for most facilities has been completed; however, only a small percentage have undergone a quality check. None of the notebooks which were quality checked have been revised. Even when/if the first document is fully completed, it will be unuseable because it fails to account for external events, does not allow for the assessment of multiple failures, does not provide an adequate allowance for reasonable operator recovery actions, and requires numerous (currently undocumented) special rules to use.

NRC Manual Chapter 0609 specifies that issues which affect external events and containment findings must be evaluated by an SRA using a SDP Phase 3 process. Consequently, most conditions assessed by the Phase 2 process will require a Phase 3 evaluation. This results in a duplication of effort between inspection and risk analyst personnel. The duplication of effort is an inefficient use of resources.

The Phase 2 notebooks are a cumbersome and time consuming process. Phase 3 analyses for potentially significant issues have been performed since the inception of the revised oversight program without substantially increasing the burden on the risk analyst. Additionally, the increased use of advanced risk trained individuals should allow regional SRAs more time to focus on complex significance determinations. In any event, Phase 3 results for single conditions are less time consuming than a Phase 2 analysis. A single condition issue (auxiliary feedwater train unavailable) assessed via the Phase 3 process requires that the analyst know 3 numbers: The baseline CDF, the risk achievement worth, and the duration. Note that this process frequently occurs when issues are first identified. It is a common practice for inspectors to contact a risk analyst in order to screen issues before investing inspection resources. Estimated time to get a reliable first cut on the risk significance: 1-2 hours. This includes a discussion with the licensee's risk analyst to confirm the results. The process is essentially complete for licensee's which have included external events in the probabilistic risk assessment (PRA) model. For all other licensee's, a qualitative assessment of the impact of external events on the safety significance must be performed (THIS QUALITATIVE ASSESSMENT IS NO DIFFERENT THAN WHAT IS REQUIRED TO BE PERFORMED FOR ANY PHASE 2 OR 3 ANALYSIS).

From personnel experience, the estimated time consumed to complete a Phase 2 analysis for a single condition (auxiliary feedwater train out of service) is 1-2 days. The uniformed inspector must review MC 0609, refresh themselves on the rules associated with the analysis, and then complete the process. Note that because auxiliary feedwater affects external events, the inspector must then review the IPEEE and qualitatively re-assess the significance of the finding. If the finding is affected by external events, then a SRA must do a Phase 3 analysis.

Approximately 30 percent of the conditions evaluated by the SDP Phase 2 notebooks are not impacted by external events or large early release frequency. All other types of findings bypass the Phase 2 process. These include, but are not limited to; multiple conditions, external events, shutdown operations, initiating events, and containment findings. The level of effort on the part of the NRC staff to continue the development of a tool which can only be used to assess single condition at-power findings that do not involve external events or containment integrity is an inefficient and ineffective use of NRC resources.

No data was available to determine the number of times a Phase 2 evaluation screened an issue as significant and the Phase 3 evaluation screened the issue as non-significant. For example, Riverbend Station had two issues which were greater than green based on the Phase 2 analysis. A subsequent Phase 3 analysis demonstrated that the issues were of very low safety significance. The hours of resources to complete the Phase 2 analyses could have been better utilized if the issues were evaluated with a Phase 3 analysis following the Phase 1 screening process.

Brookhaven National Laboratory (BNL) quality has been, and continues to be very poor. Large quantities of money were allocated and in return the NRC had to expend additional resources to revise the BNL output. At one point the quality of the work product was so low that NRR began a process where a risk analyst was required to travel to BNL to review each notebook before completion. Even then, BNL failed to make required changes for item-by-item comments. Following the BNL site visits, the Agency completed several benchmarking trips at selected facilities. These trips identified significant weaknesses in the Phase 2 notebooks. Several additional deficiencies were also identified. These weaknesses and deficiencies will require the allocation of additional funds and resources to upgrade the Phase 2 notebooks. Instead of suspending future contracts/business with BNL until quality control standards were implemented, the NRC awarded the additional contracts to develop Phase 2 notebooks for shutdown operations. The lack of an up-front quality standard resulted in a significant reduction of effectiveness and efficiency.

The plans for the Phase 2 shutdown model are to be extrapolated from shutdown PRA models developed for Grand Gulf and Surry. The intention is to develop generic notebooks for shutdown conditions. These may or may not be reflective of actual shutdown conditions for every facility. In addition, the same deficiencies associated with the at-power notebooks will more than likely exist in the generic shutdown notebooks. Consequently, the same inefficiencies, burdens, and impacts on safety will also exist. A review of NUREG/CR 6143, “Evaluation of Potential Severe Accidents During Low Power and Shutdown Operations at Grand Gulf, Unit 1,” was completed to determine if the Grand Gulf practices and assumptions were current. Based on the review, the results of the NUREG/CR 6143 study should not be used until a detailed analysis of current operating practices is completed (See attached summary).

Differing View - The Phase 2 Process Places a Regulatory Burden on the Licensee

The result of the Phase 2 analysis is frequently over conservative. The over conservatism should not be viewed as a positive feature. Processing findings as greater than green solely on the output of a Phase 2 analysis will result in excessive regulatory and financial burdens on both the licensee and the NRC as they prepare for and respond to unnecessary regulatory information conferences and significance determination process and enforcement review panels (SERP).

A review of the post-benchmark results for 33 conditions evaluated at the Cooper facility and 22 conditions evaluated at the San Onofre facility was completed. The review determined the that approximately 76 percent of the Cooper conditions and 50 percent of the San Onofre conditions would result in an over conservative result at least 50 percent of the time (See attached data sheets).

The current guidance from the NRR program office and the proposed draft of NRC Manual Chapter 0609 specify that a SERP should be conducted based on the outcome of the Phase 2 analysis. Given the high percentage of over-conservative results, licensee's would be required to expend financial and personnel resources to prepare for a SERP which will more than likely result in a lowering of the Phase 2 significance determination. This type of approach results in an unfair regulatory burden on the affected licensee.

Why have a SERP to discuss the result of a Phase 2 finding which will in most instances be incorrect? Any issue which screens as potentially significant during the Phase 2 process should require further analysis (Phase 3). Once again, why have a Phase 2 process if a Phase 3 analysis needs to be performed for any adverse Phase 2 result? The duplication of effort is an inefficient use of resources and unnecessarily prolongs the resolution of the finding.

There is a misperception between staff personnel as to what constitutes a Phase 3 analysis. These misperceptions are fueled by the failure to develop adequate training for risk analysts and the failure to develop a methodology by which to complete a Phase 3 analysis. The failure to have a standard approach to risk analysis was documented in OIG Audit Report 99A-03. This issue remains unresolved.

Given the current tools available to the analyst (Current tools include: the licensee's IPE, the licensee's IPEEE, the licensee's insights from PRA model updates, the licensee derived importance measures, the licensee derived sequence cutsets, and communications with licensee risk analysts), a Phase 3 analysis can be as simple as manipulation of three numbers (RAW, CDF, and duration). A comparison of this result can be made to the licensee's full model PRA quantification. Additionally, the analyst could compare the order of magnitude changes and dominant cutsets from the licensee's model to the output of the SPAR model. The total time to do all of this is less than the time to complete a Phase 2 analysis. With the exception of the SPAR model manipulation, every certified inspector should be able to perform this type of Phase 3 analysis.

The perception that Phase 3 analyses are resource intensive is due in large part to issues which are highly complex. These issues involve large degrees of uncertainty, affect multiple components, and require operator recovery actions (Fire protection issues and Cooper EQ). These types of Phase 3 analyses are infrequent and are not representative of the more routine

types of analyses. Because of the lack of a standard methodology, there is often disagreement between analysts on the assumptions and results of the Phase 3 analysis. The lack of a standard methodology results in extended periods of time to resolve these issues and unnecessarily impacts staff efficiency and effectiveness.

NRC management frequently indicates that the Phase 2 notebooks provide invaluable risk insights to inspectors. The extra insights that reportedly exist include: system dependencies, accident sequences, and an appreciation of important equipment given the failure of another component. NRR management has significantly overstated the insights provided by the Phase 2 notebooks. Specifically, (1) All NRC inspectors are required to complete PRA training. This training provides inspection personnel with the ability to locate, interpret, and apply risk information specified in Individual Plant Examinations, Individual Plant Examinations of External Events, and updated probabilistic models. (2) All NRC inspectors must complete a qualification program before certification. This program requires that inspection personnel become familiar with the use of risk insights. (3) Inspectors are familiar with the significant contributions to core damage for there assigned facilities, including dominate accident sequences. (4) The qualification process requires that inspectors become familiar with system functions and dependencies. (5) Look closely at the system dependency table. Pumps are dependent on AC power. How useful is this information to an inspector?

A review of OE data from October 23, 2001, indicated that there had been 33 findings with an initial significance of greater than green. 18 of the 33 findings involved the initiating event, barrier, or mitigating system cornerstones. 8 of these 18 findings (44 percent) were downgraded in significance. 6 of the 8 were downgraded to green. Performing a SERP for issues which will be downgraded places an unfair regulatory burden on the licensee and wastes NRC resources.

<u>The NRC Does Not Need Two Separate Assessment Tools!</u>:

Parallel to the Phase 2 notebooks, the NRC has already invested and plans to allocate additional resources into the development of the software driven SPAR models. The SPAR models not only duplicate the minimal features of the Phase 2 notebook, but also provide additional features which the Phase 2 notebooks are incapable of performing (event assessment, multiple deficiencies, dominant sequence cutsets, quantification of results, and more). With an improved end user interface, the SPAR models have the potential to be an independent assessment tool which can easily be utilized by inspection staff, analysts, and management. Use of the SPAR model requires significantly less time than a Phase 2 or 3 analysis. The SPAR models have the potential to provide reliable insights into significant risk conditions and events. These insights would substantially exceed any insights which might be provided by the Phase 2 notebooks.

SPAR models, if properly developed, would be the most independent tool the Agency has to assess safety significance. Specifically, the SPAR models were derived from a review of generic industry data as well as plant IPEs. A quality check of the SPAR models which includes a comparison of basic event probabilities to the licensee's model could identify and resolve discrepancies with both the SPAR models and the licensee's PRA models. It is conceivable, that the SPAR models could be used as an independent one stop resource for the assessment of findings. A resource the Agency could use to make confident and informed decisions without an over reliance on licensee input. Additionally, this type of decision making would significantly reduce the current dependency on senior reactor analysts.

Interim Actions:

1. Discontinue the use and development of the at-power and shutdown Phase 2 notebooks.

2. Development of the SPAR models should be suspended until the NRC has developed a integrated position on what the SPAR model should be able to accomplish. This step is necessary to prevent incremental and costly modifications of the model.

3. Evaluate which assessment tool/method will result in the most accurate result with the best use of resources. The NRC needs to stop expending resources until a plan is developed which articulates what tools are needed, what the tools should be able to accomplish, what will be necessary to develop the tools, and when the tools should be available to the staff.

4. Obtain current importance measure tables for each facility. The tables should be used to assess the significance of single condition inspection findings. These table already exist as a part of the licensees' PRA models.

5. Develop a standard methodology for completing all types of Phase 3 analyses.

6. Fully integrate the use of individuals which have completed advanced risk training.

REVIEW OF GRAND GULF SHUTDOWN PROBABILISTIC RISK MODEL

A comparison of current shutdown operating practices at Grand Gulf to NUREG/CR 6143, "Evaluation of Potential Severe Accidents During Low Power and Shutdown Operations at Grand Gulf, Unit 1," was completed. Per conversations with the licensee, the shutdown model was never maintained or revised.

The review determined that the current shutdown operating practices at Grand Gulf probably do not correspond to the assumptions used in the NUREG/CR 6143 study. An on-site visit would be needed to provide a complete perspective on the scope of the differences between current practices and NUREG/CR 6143. Additionally, the following assumptions should be validated before the results documented in NUREG/CR 6143 are used for any current assessments or projects.

Purpose:

The purposes of the review were to: (1) evaluate the validity of the assumptions utilized in the NUREG/CR 6143 study, (2) compare the assumptions to current plant operating practices, and (3) determine areas of concern for use of the NUREG/CR 6143 study prior to implementation of the Significance Determination Process (SDP) Phase 2 Notebooks for shutdown plant conditions.

Conclusions:

The current practices at Grand Gulf are probably not representative of the assumptions in the NUREG/CR 6143 study. Per conversations with the licensee, the shutdown model was never maintained or revised. The assumptions listed below should be validated before the results documented in the NUREG/CR 6143 are used for any current assessments.

Background:

In 1995, the NRC published a study on plant risk during lower power and shutdown operations. The study was performed by Sandia National Laboratory and is documented in NUREG/CR 6143. Phase 1 of the project was completed in 1991. Phase 1 consisted of a coarse screening of potential accidents that could occur at a boiling water reactor for other than full power conditions. Phase 2 of the project was completed in 1994. Phase 2 consisted of a detailed review of one of the seven shutdown plant operating states (POS).

The reviewers selected POS 5 for the analysis. POS 5 consisted of three time windows (TW). TW-1 was the period between initiation of cold shut down (less than 200 degrees Fahrenheit) to 24 hours after shutdown. TW-2 was the period between 24 hours post shutdown to POS 6 (Vessel head off and vessel level at the main steam line). The estimated period for TW-2 was 70 Hours. TW-3 was the period after completion of core alterations. TW-3 commenced 40 days after shutdown and lasted 10.5 days.

The reviewers determined that approximately 59.5 percent of the core damage frequency (CDF) occurred in POS 5. Approximately 37.8 percent of the CDF occurred in POS 6. POS 4 (Plant in hot shutdown with the residual heat removal system in the shutdown cooling mode of operation) and POS 7 (Reactor vessel head removed and reactor cavity filled) accounted for the remaining 2.3 percent of the CDF. POS Groups 1, 2, and 3 were not evaluated in that were considered part of the at-power risk model.

Assumptions to be Validated:

1. Durations for the TWs are not realistic. Actual durations spent in each time window is of concern in that the decay heat rates could be substantially different. One of the major contributors in determining CDF and large early release frequency (LERF) is the time available to operators to implement mitigating and/or recovery actions. For shutdown plant conditions, the decay heat rate and time spent in the associated POS are the major inputs in determining the amount of time available to plant operators.

   - TW-1 assumed that Mode 5 was entered within 24 hours. Need to determine the number of hours it takes Grand Gulf to reach Mode 5.

   - TW-2 was assumed to last 70 hours. Need to determine the number of hours Grand Gulf spends in Mode 5 before detensioning of the reactor vessel head. TW-2 is expected to occur between post shutdown hours 24 and 96. Need to determine when Grand Gulf would be in TW-2.

   - TW-3 was not expected to commence until post shutdown day 40. It was assumed to last 10.4 days. Need to determine the number of hours it takes Grand Gulf to reach TW-3 and the duration of the window.

2. NUREG/CR 6143 assumed that the alternate decay heat removal (ADHR) system did not isolate automatically on high pressure. Later in the text, (Volume 2, Part 1, Page 3-5) NUREG/CR 6143 stated that ADHR would automatically isolate on high pressure. Automatic protection of ADHR would reduce risk in that the over-pressurization sequences would be affected.

3. NUREG/CR 6143 required at least 2 safety relief valves (SRVs) for feed and bleed to prevent over-pressurization of ADHR. What are the plant requirements for availability of SRVs while shutdown?

4. NUREG/CR 6143 assumed that scenarios existed where the main steam isolation valves (MSIVs) were open because no licensee controls were identified. MSIVs would need to be re-closed during a loss of coolant accident (LOCA) event within 5 minutes. Consequently a human error probability of 1.0 was assigned to closure of the MSIVs. The MSIVs would need to be re-closed within 20 minutes to prevent flooding. Need to validate administrative controls for MSIVs.

5. NUREG/CR 6143 assumed the suppression pool was considered empty for 25 percent of the outage. Need to validate administrative controls for suppression pool.

6. NUREG/CR 6143 assumed that suppression pool automatic make-up from upper pool was not available. The unavailability of the upper pool was a significant contributor to CDF for the large LOCA and medium LOCA sequences. Need to validate existence of administrative controls for suppression pool make-up.

7. 37.8 percent of the CDF occurred in POS 6. No discussion on the importance of systems in POS 6 compared to POS 5 was provided. POS 6 was not evaluated in detail. The use of NUREG/CR 6143 could affect the outcome of shutdown SDP notebooks.

8. Containment flooding and failure to close lower containment access were assumed to result in a loss of plant systems. Need to validate administrative controls for lower containment access and the effect of not closing this access point.

9. No consideration was given for extended POS 4 or POS 5 operation. Need to assess the risk associated with forced outages. TW-2 was the most significant portion of POS 5; however, the duration was only evaluated for 70 hours.

10. The pressure rating of ADHR was assumed to be 80psig. The pressure rating of the residual heat removal (RHR) system was assumed to be 220 psig. Need to validate actual pressure ratings of the affected systems.

11. Volume 1, Section 3.1.1, Page 4, specified that the development of a detailed methodology for analyzing human actions during shutdown conditions was underway, and analysis of such events was deferred until the methodology was available. Need to determine if a methodology was ever developed and if the variations in operator actions could have a significant impact on CDF.

12. NUREG/CR 6143 assumed that core can be cooled with 250 gpm of makeup water. Credit is given for control rod drive (CRD), which has a capacity of 240 gpm, as a success criteria. Need to validate the actual success criteria.

13. The station blackout (SBO) scenario credited the ability to maintain SRVs available. Can Grand Gulf maintain an SRV available. Are there procedures and equipment pre-staged?

14. What is the availability of fire water systems while shutdown?

15. High pressure injection systems were credited as a means of reducing CDF. What is the status of the high pressure core spray (HPCS) system during outages?

16. LERF impacts were associated with a lack of containment heat removal and hydrogen control. These issues are probably not of concern for shutdown applications and in some at-power scenarios

17. NUREG/CR 6143 assumed that Train A was unavailable. What is the licensee's practice for maintaining the availability of two or more divisions of equipment?

18. Hydrostatic testing was assumed to occur at day 30. What is the licensee's current practice for hydrostatic testing?

19. NUREG/CR 6143 used a truncation level of 1E-8. This is a very high threshold for truncation using current standards. 1E-12 or 1E-13 would be more appropriate.

20. The reactor core isolation cooling (RCIC) system was not credited. There are certain scenarios in which RCIC may be available to mitigate an event. What are the licensee's practices for removal of the RCIC system during an outage?

21. NUREG/CR 6143 assumed that fire protection was available when the emergency diesel generator (EDG) was removed from service. Need to validate plant restrictions on diesel driven fire pumps during periods of EDG unavailability.

22. SECY 00-0007 specified that human error is a dominant contributor to shutdown risk. However; NUREG/CR 6143 did not use a detailed human reliability analysis for the study. Need to validate the assumptions used by Grand Gulf for human error probabilities. These probabilities should be compared to the generic shutdown SDP values.

23. SECY 00-0007 specified that shutdown risk was dependent on plant specific information. However, the shutdown SDP plans to use generic plant information. What activities are planned to assess the validity of the use of generic information for conducting plant specific SDP evaluations?

24. External events were not a major concern for Grand Gulf in the NUREG/CR 6143 study. How is the application of external events to be incorporated into the shutdown SDP process?

25. Need to compare the current Grand Gulf shutdown risk assessment tools to industry guidance. Need to evaluate the level of validation and verification of the risk tools.

References

- NUREG/CR 6143, “Evaluation of Potential Severe Accidents During Low Power and Shutdown Operations at Grand Gulf, Unit 1”
- SECY 00-0007, “Proposed Staff Plans for Low Power and Shutdown Risk Analysis Research to Support Risk Informed Regulatory Decision Making”
- NUMARC 96-01, “Guidelines for Industry Actions to Assess Shutdown Management”
- EPRI TR-113084, “Development of Shutdown Probabilistic Safety Analysis (PSA)/Shutdown Equipment Out of Service (EOOS) for River Bend Station”